

**PATENT APPLICATION**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re the Application of:

MUSTONEN et al

Group Art Unit: Not yet assigned

Application No.: New Continuation Application

Examiner: Not yet assigned

Filed: November 21, 2003

Attorney Dkt. No.: 60279.00067

For: UTILIZATION OF GEOGRAPHIC LOCATION INFORMATION IN IP  
ADDRESSING

**CLAIM FOR PRIORITY UNDER 35 USC § 119**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

November 21, 2003

Sir:

The benefit of the filing dates of the following prior foreign application(s) filed in the following foreign country(ies) is hereby requested for the above-identified patent application and the priority provided in 35 U.S.C. §119 is hereby claimed:

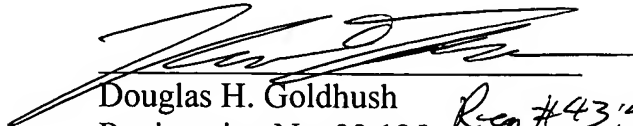
**Finnish Patent Application No. 20011075 filed on May 22, 2001 in Finland**

In support of this claim, certified copy(ies) of said original foreign application(s) is filed herewith.

It is requested that the file of this application be marked to indicate that the requirements of 35 U.S.C. §119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document(s).

Please charge any fee deficiency or credit any overpayment with respect to this paper to Counsel's Deposit Account No. 50-2222.

Respectfully submitted,

  
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Enclosure: Priority Document(s) (1)

PATENTTI- JA REKISTERIHALLITUS  
NATIONAL BOARD OF PATENTS AND REGISTRATION

Helsinki 15.9.2003

ETUOIKEUSTODISTUS  
PRIORITY DOCUMENT



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Patenttihakemus nro  
Patent application no

20011075

Tekemispäivä  
Filing date

22.05.2001

Kansainvälinen luokka  
International class

H04L

Keksinnön nimitys  
Title of invention

**"Utilization of geographic location information in IP addressing"**  
**(Maantieteellisen paikkatiedon hyödyntäminen internet osoitteissa)**

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä Patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

  
Pirjo Kaila  
Tutkimussihteeri

Maksu 50 €  
Fee 50 EUR

Maksu perustuu kauppa- ja teollisuusministeriön antamaan asetukseen 1027/2001 Patentti- ja rekisterihallituksen maksullisista suoritteista muutoksineen.

The fee is based on the Decree with amendments of the Ministry of Trade and Industry No. 1027/2001 concerning the chargeable services of the National Board of Patents and Registration of Finland.

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## Utilization of geographic location information in IP addressing

The invention describes a way to utilize geographic location information in creating a globally unique IP address to stationary equipment, which is connected to the Internet, Intranet or other network connected to IP network. It also describes how this addressing can be used for mobile equipment and what are the benefits of applying this principle.

The IP addressing is organized according to IETF recommendations. The main principle is that IP addresses are divided in two parts: Prefix and Suffix. In Ipv6 networks the Prefix part of the address indicates uniquely a certain link or subnet. Typically the routers are organized so that they know the Prefix addresses which are allocated for the router, and the router routes the received packets to respective links or subnets. The packets, which are not targeted to any link or subnet directly, connected to the router, are routed according to routing tables to other routers. The routers are typically connected to each other with multi level hierarchical structure. Also connections between "same level" routers with direct connections are possible if routing tables are organized accordingly.

The Suffix part of the address indicates a host in the link. Typically a link in IP network is an Ethernet Local Area Network (LAN) or a Wireless Local area Network (WLAN). So each computer connected to the IP network has an address, which consists of Prefix and Suffix. The Prefix part indicates one router port where the respective link is connected. In the link the computers and equipments are addressed with Suffix address (=link address). The Suffix address has to be a unique address in the link.

In Ipv6 network the stateless address autoconfiguration of the network is managed so, that the hosts connected to the link adopt their link address from the MAC address of the network card. MAC addresses are supposed to be unique when the MAC addresses to network cards are given to cards according to EUI-64 standard. This standard requires manufacturers of the network cards to follow the standard and give unique address to network card from the address space allocated for them. The router advertises it's address to the link and so basically any computer can autoconfigure itself to the network by adopting the IP prefix part of the address from the router advertisement and by adopting the link address from the MAC address. Other way for address autoconfiguration according to IPv6 recommendations is the statefull auto-

configuration, where a central DHCPv6 server allocates addresses for hosts on request.

5 The drawback in the prior art addressing is, that the autoconfiguring is not always possible. The MAC address can have duplicates; so several cards can in practice have the same MAC address. Also the information of MAC address typically has no other added value for the user of the computer/network.

10 The geographical location information can be used instead of the MAC address in forming of the IP address. The main idea of the invention is following: Instead of MAC address the geographical location information of the device is coded to Link address field. The geographic information can contain the longitude, latitude and altitude information. On top of geographic coordinate information, also name, address, serial number or any other information giving value added info to user can be coded into the address. Main principle is that the address remains unique in the link. The adoption of geographic location and other additional information can be made fully automatic with the help of positioning and other recognition technologies. The location information can be given also manually. The uniqueness of the address in the link is handled with the autoconfiguration techniques, which are already commonly known.

20 It is also possible to extend this geographical location based addressing to layer 3 router network. This can be done in subnet level addressing. The subnets are addressed based on the geographic location of the routers, which connect them to IP network.

25 Mapping of geographic address directly to Ipv6 address field enables also all the ad-hoc, mesh and other networks, which have their addressing based on one, two, three or more dimensional geographic addresses (= geographically addressed networks), to seamlessly integrate into IP network. If the node in the geographically addressed network is stationary, the IP address configured in this manner can be used also in the IP network to identify the host globally.

30 If the node is mobile, a separate service is needed in the network, which map the geographic location to "fixed" IP addresses, which can be formed based on the MAC addresses or generated by any other accepted manner. The geographic location of the mobile nodes can be presented by using a "mobile IP address" where the location is coded in the link address field, or by using any other method for coding the location information. This service can be gener-

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ated e.g. by a separate server which is located either in the IP network or in the geographically addressed network. In this case the geographically addressed networks form one or several links from the IP network perspective. If the geographic location based addressing is used in the layer 3 networks, a similar service mapping the IP-addresses of the subnets and the geographic location based addresses must be available either in the IP-network or in the geographically addressed subnet.

The advantage of the invention is, that with addressing based on geographic location, the configuring of the link can be fully automatic, without the need of coordinating the allocation of unique MAC addresses between the device manufacturers. If the geographically based addressing is used in layer 3, the configuring and routing table generation of this net can be fully automatic. The further advantage is that the applications and the users can easily receive the geographic location information of the network device when it is inbuilt into the IP address of the device. The location information can be utilized in the geographically addressed network to improve the network performance; one example is to use it in the routing algorithm of an ad-hoc network to improve the routing performance. Further, this kind of addressing based on geographical location can be utilized in optimizing the radio connections between nodes, because the distance and direction of the destination node is known from the location-based addresses. Location based services and service discovery functions, like finding the nearest printer, are easy to realize as the addresses directly indicate the geographic location of the device. Also the geographically addressed networks are easy to integrate seamlessly to any IP based networks by using this principle.

Figure 1. shows one example of mapping the location based address to the IP address. The figure 1 shows the structure of a mobile device IP address. The IP address of the mobile device is generated as a combination of the location server's address and the terminal number of the mobile terminal. The location server's address is at the same time an IP address and the suffix part indicates the location of the server globally. Certain combination of L and terminal # bits indicates, that the address is for a location server. The mobile terminal updates it's location to the location server regularly. The location server gives terminal's actual location based address to node which communicates with the mobile node. The L bit in the figure 1 is an example of coding other relevant information to the address.

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## Patent Claims

An IP network which is:

- 5 1. Characterized by that the addressing of the nodes or hosts is based on their geographical location, so that this location information is coded in to the IP address.
2. Characterized by that the addressing of subnets is based on the geographic location of the routers, so that the location information is coded in to the IP address.
- 10 3. Characterized by that the addresses generated according to the principle in claim 1 or 2 are used to improve the network performance by using this information in routing, forwarding of switching of the packets.
- 15 4. Characterized by that the addresses generated according to the principle in claim 1 or 2 are used to improve the network performance by using this information in directing the radio signal to destination when radios are used in physical layer.
- 20 5. Characterized by that the addresses generated according to the principle in claim 1 or 2 are used to improve the network performance by using this information for adjusting the radio parameters including but not limited to power level.
6. Characterized by that the location information in the IP address generated according to the principle in claim 1 or 2 is used for service or equipment discovery, location based services, or navigation.
- 25 7. Characterized by that the addresses generated according to the principle in claim 1 or 2 include also some combination of globally or locally generated node specific information, such as e.g. name, street address, serial number, color or weight.

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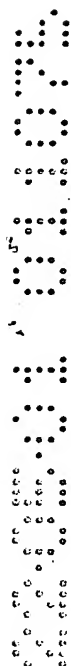
The invention describes a way to utilize geographic location information and other node specific information in creating a globally unique IP address to stationary equipment, which is connected to the Internet, Intranet or other network connected to IP network. It also describes how this addressing can be used for mobile equipment and what are the benefits of applying this principle. This addressing principle can be applied both for link layer and network layer.

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### Sammandrag

Den här inventionen beskriver hur man använder geografisk position och annat nod specifik information när man skapar en global unik IP address för statisk apparat, som är kopplat till Internet, Intranät, eller någon annan IP nät. Också beskrivs, hur denna adressering kan användas för mobila apparater och vilka fördelar denna princip förbjuder. Denna adresseringsprincip kan användas både i link nivå och nät nivå (layer 2 eller 3).



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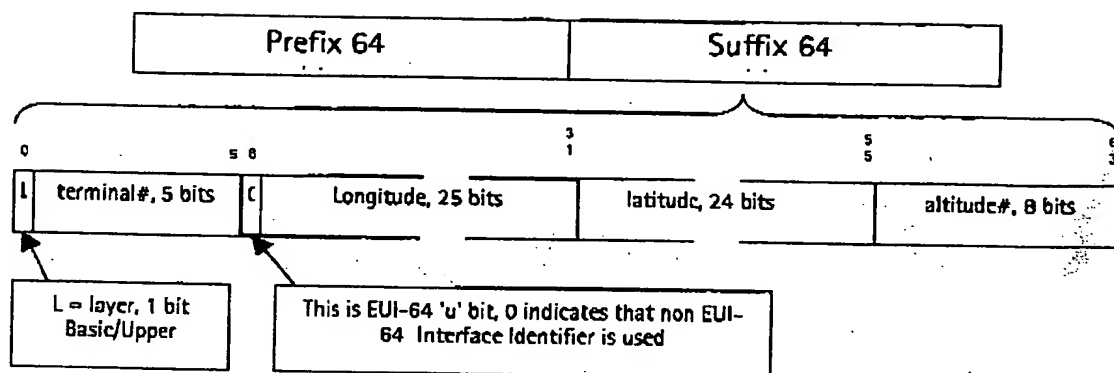


Figure 1.